PROVINCE LAKE

2019 SAMPLING HIGHLIGHTS

Station – 1 Deep

Wakefield, NH and Parsonsfield, ME

Extension

Station 1 Deep (Figure 7) was used as a reference point to represent the overall Province Lake water quality. Water quality data displayed in Tables 1 and 2 are surface water measurements with the exception of the dissolved oxygen data that were collected near the lake bottom.

Blue = Oligotrophic

Yellow = Mesotrophic

Red = Eutrophic

Gray = No Data

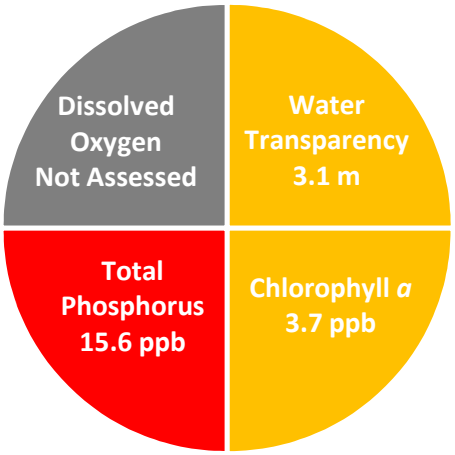


Figure 1. Province Lake Water Quality (2019)

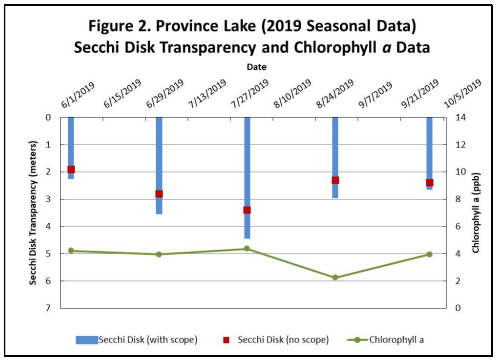
Table 1. 2019 Province Lake Seasonal Averages and NH DES Aquatic Life Nutrient Criteria[1]

Parameter	Oligotrophic	Mesotrophic	Eutrophic	Province Lake Average (range)	Province Lake Classification
Water Clarity (meters)	4.0 – 7.0	2.5 - 4.0	< 2.5	**3.1** meters (2.2 – 4.2)	Mesotrophic
Chlorophyll *a* [1] (ppb)	< 3.3	> 3.3 – 5.0	> 5.0 – 11.0	**3.7** ppb (2.2 – 4.4)	Mesotrophic
Total Phosphorus [1] (ppb)	< 8.0	> 8.0 – 12.0	> 12.0 – 28.0	**15.6** ppb (12.1 – 18.0)	Eutrophic
Dissolved Oxygen (mg/L)	5.0 – 7.0	2.0 – 5.0	<2.0	Not Assessed	Not Assessed

* Dissolved oxygen criteria not assessed due to the lack of a deep cold water layer in Province Lake.

Table 2. 2019 Province Lake Seasonal Average Accessory Water Quality Measurements

Parameter	Assessment Criteria					Province Lake Average (range)	Province Lake Classification
Color (color units)	< 10 uncolored	10 – 20 slightly colored	20 – 40 slightly tea colored	40 – 80 tea colored	> 80 highly colored	**27.5** color units (range: 20.3 – 39.2)	Slightly tea colored
Alkalinity (mg/L)	< 0.0 acidified	0.1 – 2.0 extremely vulnerable	2.1 – 10 moderately vulnerable	10.1 – 25.0 low vulnerability	> 25.0 not vulnerable	**6.4** mg/L (range: 5.6 – 7.1)	Moderately vulnerable
pH (std units)	< 5.5 suboptimal for successful growth and reproduction		6.5 – 9.0 optimal range for fish growth and reproduction			**7.2** standard units (range: 7.1 – 7.3)	Optimal range for fish growth and reproduction
Specific Conductivity (*u*S/cm)	< 50 *u*S/cm Characteristic of minimally impacted NH lakes		50-100 *u*S/cm Lakes with some human influence	> 100 *u*S/cm Characteristic of lakes experiencing human disturbances		**57.9** *u*S/cm (range: 54.9 – 61.2)	Characteristic of lakes with some human influence



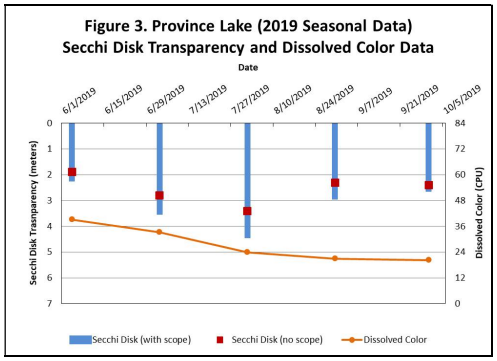


Figure 2 and 3. Seasonal Secchi Disk transparency, chlorophyll *a* concentrations and dissolved color concentrations. Figures 2 and 3 illustrate the interplay among Secchi Disk transparency, chlorophyll *a* and dissolved color. Shallower water transparency measurements oftentimes correspond to increases in chlorophyll *a* and/or color concentrations. Secchi Disk transparency data are reported for measurements collected with and without a viewing scope.

LONG-TERM TRENDS

WATER CLARITY: The Province Lake water clarity data, measured as Secchi Disk transparency, have oscillated among years and display a stable trend over a thirty-one year span of water quality monitoring (Figure 4). The long-term water clarity trend is based on the Secchi Disk transparency measurements that have been collected without a view scope.

CHLOROPHYLL: The Province Lake chlorophyll *a* concentrations, a measure of microscopic plant life within the lake, display a trend of decreasing concentrations over a thirty year span of water quality monitoring (Figure 4).

TOTAL PHOSPHORUS: The Province Lake total phosphorus concentrations, the nutrient most responsible for microscopic plant growth, display a trend of increasing nutrient concentrations over a thirty-one year span of water quality monitoring (Figure 5).

Figure 4. Province Lake (1979-2019)
Long-term Secchi Disk and Chlorophyll *a* Data

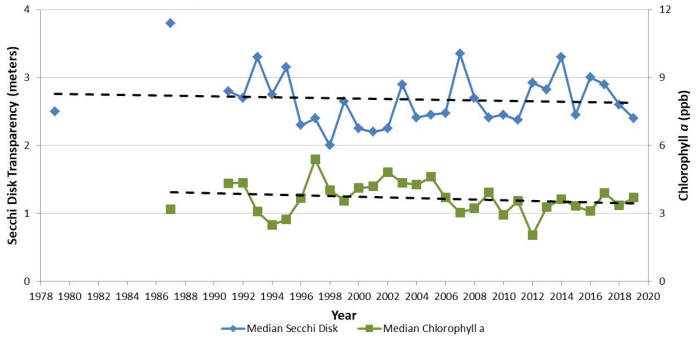


Figure 5. Province Lake (1979-2019)
Long-term Total Phosphorus Data

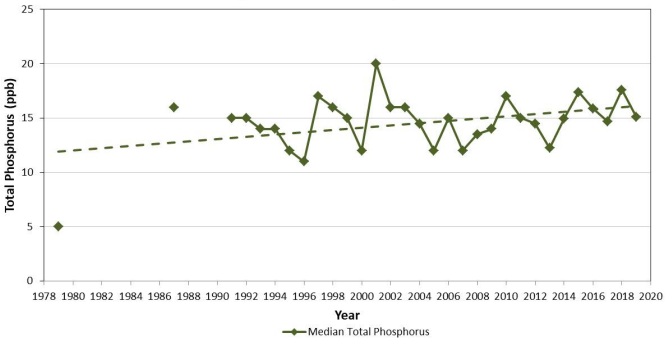


Table 3. Province Lake Steam Inlet and Outlet Seasonal Average Water Quality Inter-Site Comparison (2019)

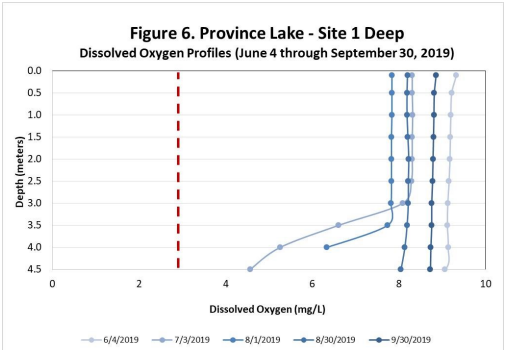
Site Name	Average (range) Total Phosphorus (ppb)	Average (range) Specific Conductivity (*u*S/cm)	Average (range) Alkalinity (mg/L)	Average (range) pH (standard units)
Campground Inlet PROEFFC	**7.8** ppb (5.1 – 9.3)	**36.6***u*S/cm (30.4 – 43.3)	**8.1** mg/L (5.9 – 9.9)	**6.9** units (6.9 – 7.0)
Golf Course PROEFFGC	**No flowing water – samples were not collected**			
Island Inlet PROEFFI	**17.2** ppb (10.0 – 23.5)	**53.1** *u*S/cm (48.5 – 55.6)	**14.5** mg/L (13.5 – 16.1)	**6.5** units (6.5 – 6.6)
Outlet PROEFFO	**16.4** ppb (11.2 – 20.6)	**58.0** *u*S/cm (54.3 – 61.5)	**6.5** mg/L (5.8 – 7.1)	**7.2** units (7.1 – 7.2)
Rt. 153 Inlet PROEFFR	**26.4** ppb (15.1 – 37.7)	**41.0** *u*S/cm (38.1 – 44.4)	**7.9** mg/L (5.7 – 10.0)	**6.2** units (6.2 – 6.3)

Note: The data *displayed in Table 3 represent the regularly sampled streams during dry weather (non-storm) sampling events.*

Figures 4 and 5. Changes in the Province Lake water clarity (Secchi Disk depth), chlorophyll *a* and total phosphorus concentrations measured between 1979 and 2019. **These data illustrate the relationship between microscopic plant growth and water clarity. Total phosphorus data are also displayed and are oftentimes correlated with the amount of plant growth.** Long-term trends are based on the analysis of annual median values.

Figure 6. Monthly Province Lake dissolved oxygen profiles collected between June 4 and September 30, 2019. The vertical red line indicates the oxygen concentration commonly considered the threshold for successful growth and reproduction of warm water fish such as bass and perch.

Figure 6. Province Lake - Site 1 Deep
Dissolved Oxygen Profiles (June 4 through September 30, 2019)



Recommendations

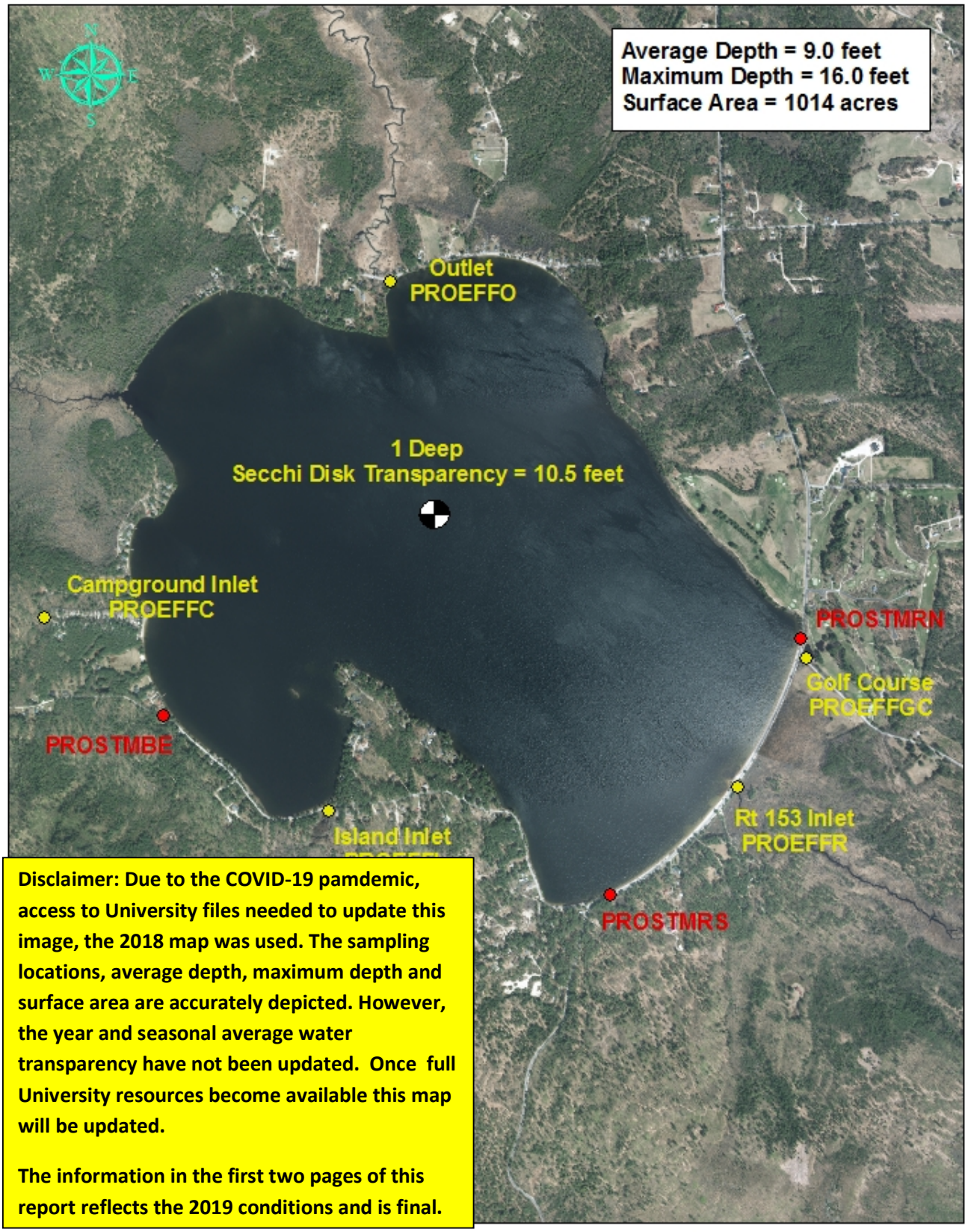
Review the "Province Lake Watershed Management Plan" that provides background information and offers potential solutions to existing water quality problems. Homeowners within the Province Lake watershed should consider implementing Best Management Practices to minimize the adverse impacts of polluted runoff and erosion on Province Lake. Homeowners can also refer to "Landscaping at the Water's Edge: An Ecological Approach" and "New Hampshire Homeowner's Guide to Stormwater Management: Do-It-Yourself Stormwater Solutions for Your Home". Both self-help documents offer relatively simple solutions to reduce nutrient loading caused by overland run-off while the Acton Wakefield Watersheds Alliance also offers technical assistance to help design and implement erosion control projects that protect your property and improve water quality.

- https://provincelake.org/cms/wp-content/uploads/2014/12/E-version_ProvinceLakeWatershedPlan_14Oct14_FINALSmall.pdf
- https://extension.unh.edu/resources/files/Resource004159_Rep5940.pdf
- https://www.des.nh.gov/organization/commissioner/pip/publications/wd/documents/wd-11-11.pdf
- https://awwatersheds.org/healthy-lakes/conservation-practices-for-homeowners/

Figure 7. Province Lake

Wakefield, NH and Parsonsfield, ME

2018 Lake and Stream sampling locations with seasonal average water clarity



Disclaimer: Due to the COVID-19 pamdemic, access to University files needed to update this image, the 2018 map was used. The sampling locations, average depth, maximum depth and surface area are accurately depicted. However, the year and seasonal average water transparency have not been updated. Once full University resources become available this map will be updated.

The information in the first two pages of this report reflects the 2019 conditions and is final.

0 0.2 0.4 0.6 0.8 Miles

Aerial Orthophoto Source: NH GRANIT
Site location GPS coordinates collected by the UNH Center for Freshwater Biology

NH Extension